SimFonIA Animation Tools

User Guide

Bring life to your lectures
Move forward with industrial design
Combine illustrations with your presentations
Convey your ideas to your customers
Test your ideas in virtual reality
Energize your meetings
Convince your investors

Simfonia
software & services

13, Avenue de Strasbourg
67400 Illkirch-Graffenstaden
Web: www.simfonia.fr
E-mail: info.sat@simfonia.fr

CONTENTS

1 Introduction

In order to facilitate the use of SAT tools, we gathered in this document:

- The general methodology of the plugin.
- The Toolbar description of the plugin.
- Tables of compatibility between the different tools of the plugin.
- A troubleshooting guide.
- A list of tips that will facilitate the use of SAT.
- A list of folders and files provided with the plugin.

2 Methodological sheets.

The three following sheets summarize the general methodology of SAT tools. We advise you to keep these documents nearby when you start using SAT.

General methodology of use

Creation of a "Physic Control" file

SAT tools give you the opportunity to directly build animations from a classic SketchUp 3D scene. Moreover, it is possible to drive the animation with data from simulation software. For that, a data file in CSV format called "Physic Control" file has to be generated. Conventional simulation tools (Matlab, AMEsim, Excel, etc.) can directly create such a file.

Drawing of a 3D scene

The SketchUp 3D scene should be drawn in accordance with some rules that will facilitate the use of SAT tools. Building of the scene can be greatly simplified by the importing of pre-animated components.

Preparation of an animation

SAT tools let you dynamically take into account gravity effects, manage collisions between objects and change entities position, size or color. Your raw simulation data (from the "Physic Control" file) will be fit to your SketchUp scene (signal scaling, averaging, etc...).

Generation of an animation

You can launch an animation of you 3D model and set its speed in order to see your transformations result.

Export results

A saved model keeps all its attributes when it is re-opened. You can generate video in the AVI format. It is also possible to produce a WebGL animation that will give you the opportunity to manipulate your model and to launch the animation in a Web page while observing the signals values of the "Physic Control" file.

Operation and visualization

Results can be displayed in many ways: directly in SketchUp, in a video, in a web page or in a local mobile viewer (smartphone or touchscreen computer). SimFonIA will provide you the means to post models and animations on a dedicated Web site.

Sharing and dissemination

SAT is designed to be a collaborative tool that let you improve the sharing and dissemination of your productions, whether you are an amateur or a professional.

To go further…

If you are involved in a multidisciplinary project, our modeling and simulation engineering team can help you to create you scientific models and our creative department can prepare 3D scenes for you.

Methodological sheet SAT V1

Creation of an external "Physic Control" file (optional)

Outside SketchUp / In case of a physic model animation

Definition of the 3D Scene

- Storyboard planning
- Drawing of the 3D scene with eventual importing of external components (re-registration of the component required)
- Checking of the surfaces' normal and flip sides if necessary
- Building of the group Hierarchy
- Positioning of the coordinate system (using the dedicated tools)
- Colorization of the group

Prepare the Animation

- Registration of Bullet groups
    - o Choice of the control mode and of the collision shape
    - o The origin of the coordinate systems are positioned at the gravity center (geometrical center)
- In case of an animation driven by physical simulation, load the "Physic Control" file
- Building of the local and global signals with the "Signal Processor"
- Creation of "Animation" and "Deformation" keyframes with the "Keyframe Editor"
- Creation of the transformations (Animation, Deformation, Rotation, Translation, Text, Color, etc.)
- Creation of the "camera" keyframes

Animation

- Choice of the animation speed
- Launching of the animation (Pause / Play – Rewind)
- Adjust (by returning to the "Transformation Processor" or by modifying the "Physic Control" file).

Results export (when the animation is satisfactory)

- Backup of the SKP file with its linked processors and transformations in the native format
- Creation of the video (intermediate images are stored or automatically deleted)
- Creation of WebGL export with:
    - o Textual descriptions
    - o Several animations possible for one single 3D model
    - o Simple animation : 2 files ("xxx.dae.gz" et "yyy.anim.gz")
    - o Animation with "Physic Control" : 3 files ("xxx.dae.gz", "yyy.anim.gz" et "yyy.csv.gz")

Using / Visualization

- In SketchUp interface
- In play video mode (board – YouTube/Dailymotion – or distributed par email/UsbKey)
- In a mobile viewer (smartphone, tablet computer…)
- In the repository viewer (Private / Public / Group on invitation, depending on your version)
- In a dedicated website
    - o Created/ host by SimFonIA
    - o Created by yourself with SimFonIA tools (Version ProWEB)

Sharing / Dissemination

- Distribution of the animated 3D scene in the SimFonIA '3D Animation Warehouse'
- Distribution of the video
- Distribution of the WebGL Animation (requires a viewer)

Toolbar SAT V1

Placement of the Coordinate System of Entities	
	Free positioning
	Positioning at the center of gravity with free alignment of the axes
	Positioning at the center of gravity with alignment of the axes on the parent axes
	Positioning at the center of gravity with conservation of the axes alignment
	Display of construction lines at the center of gravity of a surface / entity
Bullet Tools	
	Registration and definition of Bullet objects
	Definition of a 6 degrees of freedom articulation
	Articulation management between bullet objects
	Import of Animated Component
	Reregistration of imported Animated Component
Keyframe Editor	
	Keyframe Editor (Camera, Animation, Deformation)
Processors	
	Physic Control (control file)
	Transformation Processor / Signal Processor
Backup of current selection	
	Save the state of the current selection (the list of the selected blue colored elements)
	Restore a saved selection (re-select the same elements)
Animation & exportation	
	Animation speed
	Play/Continue animation
	Pause
	Stop & Rewind
	Preview window of the video
	Record a video
	Record an animation under WebGL format

3 Compatibility between SAT tools

3.1 Transformations

The following table deals with the compatibility between the transformations processors.

	Rotation Orientation Translation Position	Scaling	Color	Text	Visibility	Animation	Deformation
Rotation Orientation Translation Position	YES (1)	YES (1)	YES	NO	YES	YES (2)	YES
Scaling	YES (1)	YES (1)	YES	NO	YES	YES (2)	YES
Color	YES	YES	YES	YES	YES	YES	YES
Text	NO	NO	YES	X	YES	NO	NO
Visibility	YES	YES	YES	YES	X	YES	YES
Animation	YES (2)	YES (2)	YES	NO	YES	YES (2)	YES
Deformation	YES	YES	YES	NO	YES	YES	YES (1)

(1) : If there is an absolute transformation in the list of a group's transformations ("Scaling", "Position" and "Orientation" are always absolute, "Rotation" and "Translation" could be absolute or relative), the processor begins each time cycle by restoring the initial position of the group (the position at T = 0 s.) in the parent group.
All the following transformations will then be applied relatively to this initial position and in the order they are listed.
If one wants to combine an absolute and a relative transformation, he could position the group of interest on a support group (which could be hidden afterwards). The two groups could then be merged on a parent group where the first transformation could be applied.

(2): The tool "Animation" does not depend on the previous position of the object. This transformation places the entity at the position defined by the interpolation between keyframes. There is no problem if the transformation is followed by another absolute transformation. By contrast, the user will not see the effect of other relative transformations (unless the motion is very large). To overcome this problem, one can create a support group (which could be hidden afterwards) and merge it with the group of interest in order to create a reference parent group. The Keyframes and the transformation "Animation" will thus be related to the parent's group and the others transformations will be related to the initial child group.

3.2 Bullet Physic Engine

The following table deals with the compatibility between the Bullet physic engine and the transformations processors.

Bullet type	Rotation Orientation Translation Position	Scaling	Color	Text	Visibility	Proc. Anim.	Proc. Def.
User Controlled	YES(3)	NO (1)	YES	NO	YES (4)	YES (3)	NO (1)
Bullet Controlled	NO (2)	NO (2)	YES	NO	YES (4)	NO (2)	NO (1)
Static	NO (1)	NO (1)	YES	NO	YES (4)	NO (1)	NO (1)

1: The group can move or deform, but the shape and the size of the collision box is not updated.
2: The Bullet engine has the priority. When the object motion is no longer updated by Bullet, the transformation processor takes over. This function has to be avoided because the results are not guaranteed.
3: Registration to Bullet engine is only effective for first-level groups (whose parent is the 3D world). If it is not the case, the position and the shape of the bounding box will not change.
4: An entity continues to respond to collisions, even if it is invisible.

3.3 WebGL Exports

The following table indicates what is exportable in WebGL.

With the "Transformation Processor".

Rotation Orientation Translation Position	Scaling	Color	Text	Visibility	Proc. Anim.	Proc. Def.
OUI	YES	YES *	NO	YES	YES	NO

*: The color should be applied to a group and not directly to its faces. In addition, faces should be adjusted outwards. In this version of the plugin, material type texture cannot be exported.

Case of Bullet physic engine
All Bullet types are compatible with WebGL export.

User Cont.	Bullet Cont.	Static
YES	YES	YES

4 Troubleshooting guide

In case of problems or of an animation that does not comply with your wishes, stop the current animation, open the Ruby Console ("Window" / "Ruby Console") and re-launch the animation. In case of problems, this is where the errors are reported.

Remember to first check the following points:

- **SketchUp models that contain animations should not be directly open from their Windows folder but with the SketchUp command "File" / "Open".**
- Make sure that the path to "SATTemp" (which contains temporary backup for videos and WebGL animations) does not contain accent or special characters. Also ensure that you have access rights to that folder. Otherwise change the path using the menu "Plugins" / "Simfonia" / "Select a temporary Folder".
- Sometimes (very infrequent), a SketchUp internal error freezes the animation. In that event, save your template, exit and restart SketchUp.
- Did you comply with the operations order specified in the above methodology?
- Are you using the 8 (or higher) version of SketchUp?
- Did you read the technical FAQ on the website?

If problems persist, then check the following points:

- "Physic Control" file :
  - o Ensure that variables names are unique.
  - o Ensure that the first variable in file is the time.
- Unit and precision :
  - o Ensure that units are consistent with your SketchUp model. A displacement without unit in a scene set in meters will for example be undetectable to the eye.
  - o Check the precision of your model ("Window" / "Model Info" / "Unit length"). If the precision is too low compared to the precision of your transforms, the results may not be satisfactory.
- You should not try to edit your model during an animation. SimFonIA set up a security to avoid breaking the model but it's not 100% reliable.
- Transformations :
  - o In both transformation processor and signal processor, ensure that the generated signals are listed before the transformations or other signals which use them.
  - o The sequence of transformations that move or deform a group is very important. If the result does not meet your expectations, review the transformation order and check their compatibility in the table of the previous chapter.
  - o Also check coordinate system type (local or parent) which are associated with transformations. In some case this can have a great importance on

transformations order

- o   You can deactivate transformations to check them one by one.
- o Ensure that all transformations are activated.
- o If keyframes such as "Animation" (respectively "Deformation") are used, ensure that a transformation "Animation" (respectively "Deformation") has been really defined (and activate).

- Did you register imported component in SAT processors (⟲⟩)?

Special cases

- The Deformation tool is compatible with circles and arcs of circles only if their curves drawn by SketchUp have first been explode ("Explode Curve").
- If the camera view does not comply with your camera keyframes, make sure that they were created in perspective mode.
- The decimal symbol for all transformation is the point ".".
- The keyframes time resolution (time between two keyframes) should not be less than 1/100 time the speed factor.
- In the case of a complex and heavy animation, SketchUp preview can be degraded. However the video will not be affected and will properly render your animation. During the calculus it is recommended not to try using SketchUp. Other programs are of course functional.

Problems which are specific to WebGL

- Make sure your faces are well oriented (outgoing) before creating a WebGL export.
- Colors should be applied to groups and not the faces (in Edit Group mode) or the color will not be exported.
- If possible, avoid building faces too close before an export WebGL in order to avoid clipping phenomenon.

In the case of a persistent problem

Please send your problem to SimFonIA through the "support" section of the SAT website or send it to the following addresses:

Hotline.sat@simfonia.fr   Support for paid licence

Bugreport.sat@simfonia.fr   Bug report (add you version)

For SimFonIA to be able to perform the diagnosis, you must attach to your package:
- the email that was used to download your license
- your license number
- an explanation of your problem (in French, English or Chinese)
- the error file of Ruby Console
- the SketchUp file
- a control file (if you use one)

5 Tips

This paragraph is a list of best practices for SAT tools. They are categorized according to the SAT tool they belong to. These tips are based on the designers experience and this document is complementary to:

- Usage restrictions for SAT processors, for the Bullet physical processor and for the processor video for export to WebGL. All details can be found in the following documents "SAT_Transformation_Processor_en", "SAT_Bullet_Physic_Engine_en", "SAT_Animation_Export_en."

- Table of compatibility between SAT tools and troubleshooting guide that were presented previously in this document.

5.1 3D Scene drawing

- Use the "Outliner" window to easily navigate through the model hierarchy, name groups, etc.
- The SketchUp instructor teaches interesting commands that rely on keyboard use.
- To lock the position of a group and avoid an unintended motion, right click on the group and then check "Lock". The bounding box of a locked component is red.
- To quickly hide (respectively smooth) a large number of edges (which may have appeared during a "Deformation" transformation), select the "Eraser" tool , , and press Shift (resp. Ctrl). Move the cursor upon elements to mask while holding the left button of the mouse pressed. To unmask, move again on the elements while holding Shift + Ctrl pressed.

- When you move an object, use the arrow keys of the keyboard in order to lock the motion along a reference axis of the parent group.
    - Right arrow : X-axis (red)
    - Left arrow : Y-axis (green)
    - Up or down arrow : Z-axis (blue)
- Consider using the guide lines produced by the tool "Draw Construction Lines at Centroid" in order to :
    - Easily draw 3D objects.
    - Built relevant coordinate systems for your transformations.
    - Get in one-click the center of a circle or of an ellipse.
    - Centre your objects in relation to each other.

    Once the development is complete, it will be easy to destroy the 'Layout' in which they are contained.
- Select a group and click on the « Register » tool, ↻ , in order to quickly explode it.

5.2 Keyframe Editor

- When a group contains keyframes such as "Animation", make an habit of:
    - Creating a "support" group to be the reference of moving entities.
    - Creating a parent group that contains the entity to animate and its support group.
    - Hiding, if necessary, the support group.

    The behavior of the moving entity will thus be kept when this parent group is imported in a new model.
- The Animation tool will look for the shortest path between two positions. The interpolation can "soften" the corners of your trajectory. If you want a very specific path, preferentially use a combination of transformations.
- « Deformation » keyframes:
    - To build « Deformation » keyframes, one has to be in "Edit Group" mode.
    - To easily select all elements of a group, use the shortcut Ctrl + A.
    - Vertices number of a group that contains "Deformation" keyframes must not be modified.
- "Animation" and "Deformation" tools are compatible and can be combined.

5.3 Transformation processor

- Sequential behaviors are easy to achieve with the combination of tools for signal generation, transformation sequences and switch
- To save a component with embedded processors, simply save the ". skp." file. You can then import it as a classic entity. After the import, simply press the ↻ icon.

5.4 Bullet Physic Engine

- If a group is declared as "User controlled" in the Bullet engine, it will then still be movable by the user during the animation. This is an opportunity to test interactions or to influence behaviors. This function is not available while recording a video.
- Copy paste of groups is not compatible with Bullet (see document "SAT_V1_Bullet_Physic_Engine_en"). However, if the copied group is exploded and then recreated, you will again be able to register it properly into Bullet.
- The multiple import of a component already registered in Bullet is not a problem if the component is re-registered with the button at each import (see document "SAT_V1_Animated_Components_en").

5.5 Generation of videos

- For development purposes, the user may want to animate only a portion of a more complex video project. It is thus possible to define the start time and the duration of a video.
- Similarly, it is possible to lower the resolution and the number of frames per second during pre-production part of the project.

5.6 Additional plugins

Here are some recommended plugins to empower SAT tools capabilities:
- "Sculpt": is used to deform a group at constant vertices number. It is a very useful tool to build "Deformation" keyframes.
- "Shapes": is used to easily draw common shapes.
- Any plugin related to drawing.

Please, refer to the following document to find numerous links to plugin website. « SAT_V1_SketchUp_References_en ».

6 Basic curves

The **SAT_PhysicControl_example_V1.csv** file contains the values which allow testing your models without carrying out specific physical models. The total duration of this file is 10 seconds. You can find the descriptions and the forms of these basic curves as follows.

Nom	Période	Min	Max	Valeur initiale
Sinus_T1	1 sec	-1	1	0
Sinus_T3	3 sec	-1	1	0
Sinus_T5	5 sec	-1	1	0
Cosinus_T1	1 sec	-1	1	1
Cosinus_T3	3 sec	-1	1	1
Cosinus_T5	5 sec	-1	1	1
Cosinus_abs_T1	0,5 sec	0	1	1
Cosinus_abs_T3	1,5 sec	0	1	1
Cosinus_abs_T5	2,5 sec	0	1	1
Square_T1	1 sec	0	1	0
Square_T3	3 sec	0	1	0
Square_T5	5 sec	0	1	0
Triangle_T1	1 sec	0	1	0
Triangle_T3	3 sec	0	1	0
Triangle_T5	5 sec	0	1	0
Saw_T1	1 sec	0	1	0
Saw_T3	3 sec	0	1	0
Saw_T5	5 sec	0	1	0
Chirp	n.a.	-1	1	0
Time	10 sec	0	10	0
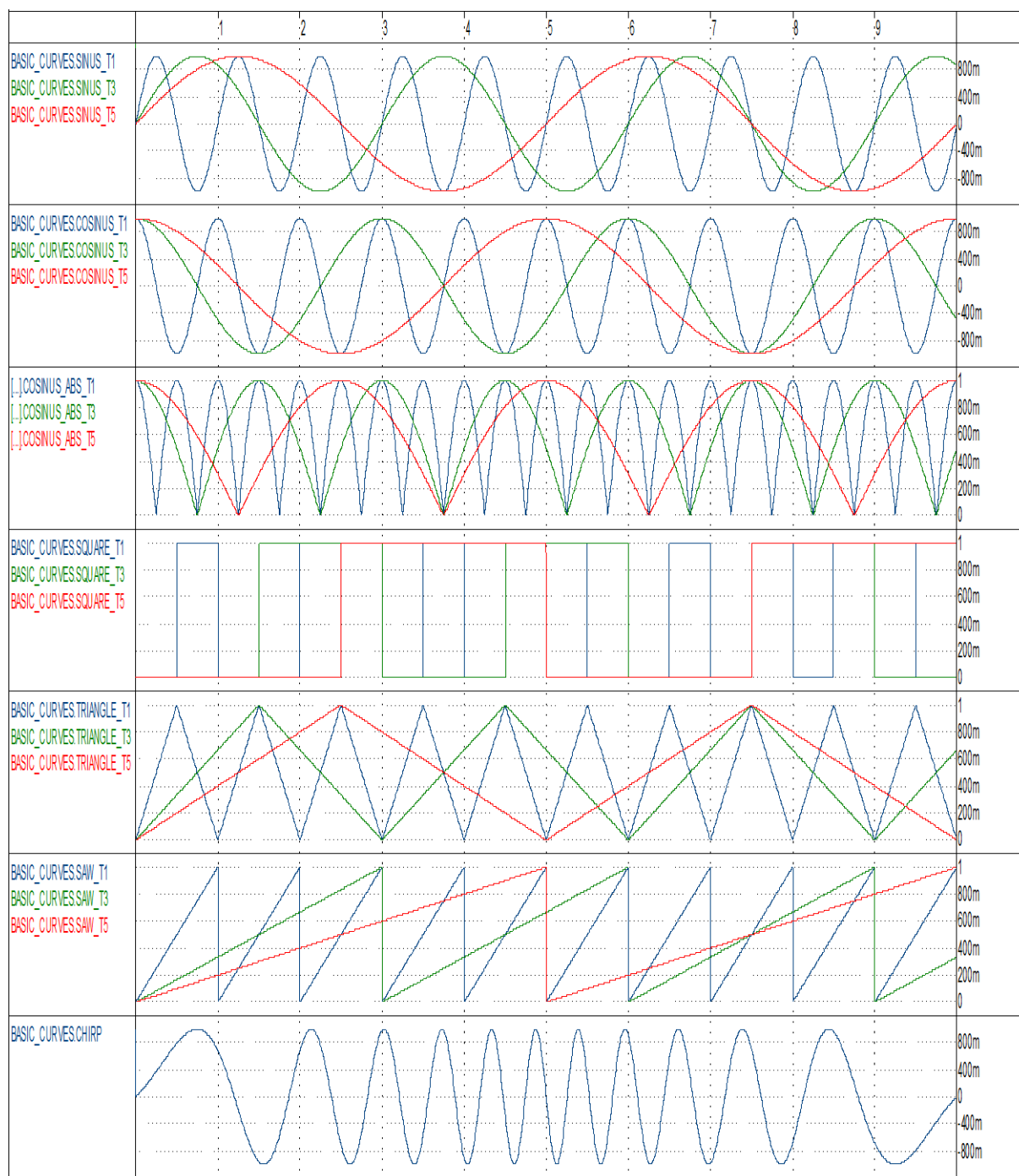
7 List of folders and files provided with SAT

The plugin SAT is provided with the following files that you will find in the directory "…\Plugins\simfonia\SAT_Data":

- **"SAT_BasicShapes**": contains classic 3D shapes as sphere, cylinder, cone, torus, etc. and some more original shapes.
- **"SAT_AnimatedComponentsExamples"**: contains some animated components ready for importing tests.
- **"SAT_Examples"**: contains the examples which are addressed in the SAT documents.
- **"SAT_PhysicControl_example_V1.csv**": the reference "Physic Control" file used in the SAT documents.